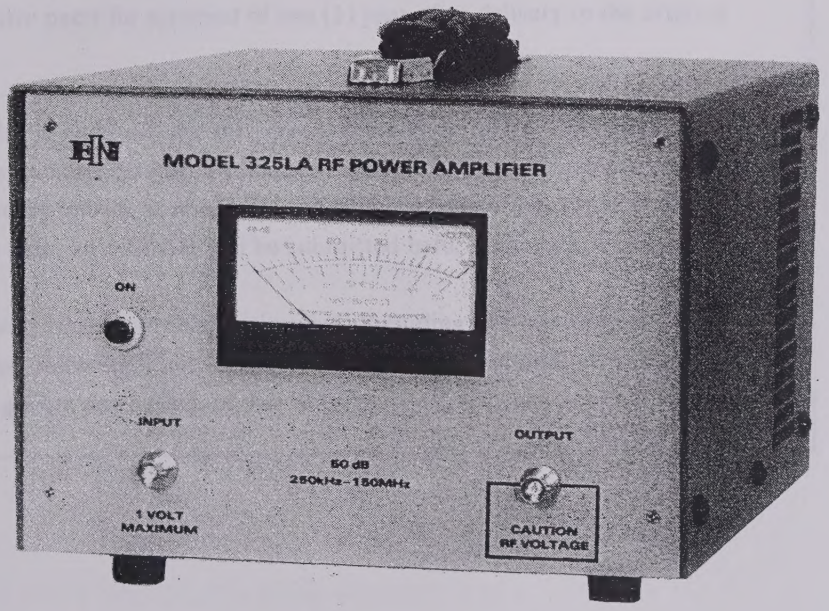
ELECTRONIC NAVIGATION INDUSTRIES, INC.

INSTRUCTION MANUAL

MODEL 325LA

BROADBAND POWER AMPLIFIER



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WARRANTY

Electronic Navigation Industries, Inc. warrants each instrument to be free from defects in material and wormanship. Our liability under this warranty is limited to servicing and replacing any defective parts for a period of one (1) year after delivery to the original purchaser.

When warranty service is required, the instrument must be returned transportation charges prepaid to the factory or our authorized service facility. If, in our opinion, the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

There are no other warranties expressed or implied, including any warranty of merchantibility or fitness. Seller shall not be responsible for any incidental or consequential damages arising from any breach of warranty.

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CHAPTER 1. GENERAL INFORMATION

1.1 INTRODUCTION

The ENI Model 325LA is an all solid state amplifier which has a flat frequency response from 250 kHz to 150 MHz. It provides up to 25 watts of linear power with low harmonic and intermodulation distortion. Gain is 50 dB nominal, with variation of less than ± 1.5 dB over the entire frequency range. Input and output impedance are 50 ohms and the unit may be driven to full power output by most RF synthesizers, signal generators and swept signal sources.

The ENI Model 325LA will deliver its rated power output into any load impedance, regardless of match. Built-in protection circuitry will absorb the power reflected from a mismatched load without causing failure or oscillation.

Output RF voltage is displayed on the front panel meter. The Model 325LA is packaged for bench mounting and is shipped with rack mounting adapters. Its integral power supply and cooling operate from a 115 or 230 VAC 50/60 Hz main supply.

The Model 325LA will raise the power level of signal sources and generators without requiring tuning or bandswitching. The Class A linear circuitry will amplify signals of AM, FM, SSB, TV and complex modulations limited only by their peak input and bandwidth, with minimum distortion.

1.2 SPECIFICATIONS

Physical and electrical specifications are listed in Table 1-1.

1.3 INSTRUMENT IDENTIFICATION

Each amplifier is identified by a serial number tag on the back panel of the unit. Both the model number and the serial number should be given in any correspondence with the company.

TABLE 1-1. SPECIFICATIONS

Frequency Coverage:	250 kHz to 150 MHz
Gain:	50 dB Nominal
Gain Variation:	±1.5 dB
Maximum Class A Linear Output:	25 watts
Harmonic Distortion:	All harmonics more than 23 dB below main signal at 20 Watts output. Lower at reduced power output.
Typical 3rd Order Intermodulation Intercept Point:	+53 dBm
Input/Output Impedance:	50 ohms
Input VSWR:	Less than 1.5
Output VSWR:	Less than 2.5
Noise Figure:	10 dB Maximum
Stability:	Unconditionally stable; unit will not oscillate for any condition of load and source impedance.
Protection:	Unit will withstand more than 13 dB of overdrive (input signal of 1V RMS) for all output load conditions.
Output Metering:	Average reading voltmeter calibrated in RMS volts for a sine wave with an accuracy of ±4% of full scale 0-50 volts; also calibrated in Watts into 50 ohms (0-50 watts)
Power Requirements:	115/230 VAC; ±8%, 50-60 Hz, 280 watts
Operating Temperature:	0° to +40°C
Size:	7.5h x 9.5w x 12.5d in. 19.1 x 24.1 x 31.8 cm.
Weight:	25 lbs; 11.3 kg.
Connectors:	BNC
Rack Mounting:	Adaptors Provided

CHAPTER 2. PREPARATION FOR USE

2.1 INITIAL INSPECTION

If damage to the shipping carton is evident, request the carriers agent be present when the instrument is unpacked, Check the equipment for damage and inspect the cabinet and panel surfaces for dents and scratches.

2.2 CLAIM FOR DAMAGE

If the Model 325LA is mechanically damaged or fails to meet specification upon receipt, notify ENI or our representative immediately. Retain the shipping carton and packing material for the carriers inspection as well as for subsequent use in returning the unit if necessary.

2.3 MAINS VOLTAGE SETTING

The Supply Voltage selection switch is located at the rear of the unit and is normally set for 115VAC operation. Before connecting the unit to the Mains Supply, check that the supply voltage switch is correctly set.

EXTENSIVE DAMAGE WILL RESULT IF THE AMPLIFIER IS CONNECTED TO THE WRONG SUPPLY VOLTAGE. UNDER NO CIRCUMSTANCES SHOULD THIS SWITCH BE OPERATED WHILE THE SUPPLY IS CONNECTED.

2.4 MAINS FUSE RATING

MAINS FUSE RATING

The Mains Fuse F1 is located on the rear panel. The replacement part number is 313004 4ASB.

2.5 RACK INSTALLATION

In order to install the Model 325LA in a standard 19 inch relay rack, the supplied mounting brackets must be attached to the over as follows:

a. Remove the snap-on chrome caps on both ends of the cover handle.

b. Remove the four #4-40 screws and lift the handle off.

c. Remove the four feet on the underside of the amplifier if the minimum vertical usage of the relay rack is necessary.

d. Remove the two #8-32 screws located at each side of the cover nearest the front panel.

e. Attach the rack mounting brackets to the sides of the unit using the screws removed in step d.

2.6 POWER CABLE GROUND PROTECTION

To protect operating personnel, the ENI Model 325LA is equipped with a three conductor cable consisting of a black hot line, a white common line, and a green chassis ground. When using a two prong adapter, the green tap on the adapter must be connected to earth ground.

2.7 COOLING

When the 325LA is enclosed by an external cabinet, provisions must be made to insure an adequate flow of cooling air to the unit. Ambient temperature of the air must not exceed 40°C.

CHAPTER 3. OPERATION

3.1 FUNCTIONAL DESCRIPTION

The ENI Model 325LA is a linear Class A amplifier capable of increasing the output of any signal generator, frequency synthesizer, sweep generator or laboratory signal source from 250 kHz to 150 MHz.

The Model 325LA is completely protected against damage due to load mismatch provided that the input RF level does not exceed 1 volt RMS or 1.4 volts peak. If the attached signal source is capable of generating substantially more than this input voltage, please use caution in adjusting it. The Model 325LA will saturate well before the maximum input voltage and there will be no increase in output power at that point.

The 325LA is unconditionally stable. Any impedance can be connected to the input and output of the amplifier, without causing oscillation.

The 325LA will deliver its rated power to any load impedance regardless of match. Load mismatch will cause RF power to reflect back to the amplifier. The unit is designed to withstand 100 percent reflected power (a pure reactance open or short circuit load will cause 100 percent reflected power) continuously without damage.

An output meter is provided to indicate the average output voltage (calibrated in RMS) as well as the power output when the unit is connected to a 50 ohm load. Since the meter responds only to average output, the modulation characteristics of the input signal must be taken into account when interpreting the meter readings. For example, the amplifier may be in saturation during the ON portion of a pulse yet the meter reading will be low due to the low duty cycle of the pulse input.

3.2 CONTROLS, INDICATORS AND CONNECTORS

Front and rear panel devices are described in Table 3-1.

3.3 OPERATING PROCEDURE

Refer to the following procedure as a guide to operating the Model 325LA.

a. The input and output are connected via the front panel BNC connectors to the signal source and load respectively.

b. The input signal should be increased gradually while observing the output voltage on the output RF voltmeter.

c. When the Model 325LA is connected to a 50 ohm load, the CW power output of the unit may be read directly from the meter scale.

d. When the amplifier is connected to an arbitrary or unknown load inpedance, the following procedure will insure a low distortion power output.

   1. Disconnect the output load cable from the output BNC connector of the Model 325LA

   2. If the CW output voltage is less than 35 volts RMS, the unit is operating at low distortion regardless of the load impedance.

   3. Reconnect the output of the amplifier to the load.

e. If the output of the amplifier is monitored by a high frequency oscilloscope or spectrum analyzer, the input signal may be increased until the point of maximum undistorted power output is observed.

3.4 PRECAUTIONS

a. The input and output of the Model 325LA should not be connected together. This will cause oscillation and may damage the input preamplifier.

b. The Model 325LA should not remain connected to an antenna when the unit is not in use. If thunderstorms are likely, it would be prudent to earth ground the unit's case.

c. When the input signal voltage of the signal source is unknown, insert an attenuator between it and the Model 325LA input.

TABLE 3-1. FRONT AND REAR PANEL DEVICES

DEVICE	FUNCTION
Power Switch	Depressing the switch "ON" connects fan and power supply to main power source.
Meter	Indicates output voltage and also power for a 50 ohm load. The meter circuit responds to the average RF voltage and is calibrated in RMS volts for a sine wave. The voltage pick-off is mounted directly behind the front panel at the output connector.
Input Connector	BNC for connection of the driving generator. Input impedance is 50 ohms. Up to 1.4 volts peak can be supplied without causing damage; however, no additional power output can be expected past the saturation point.
Output Connector	BNC for connection of amplifier output to load.
Fuse	Holder required 3 AG size, slow blow type fuse: 4ASB
Line Cord	Three prong type plug with safety ground pin connected to cabinet.

CHAPTER 4. MAINTENANCE AND PERFORMANCE TESTS

4.1 INITIAL CHECK

Before connecting the Model 325LA to the Mains Supply, make certain that the supply voltage switch on the rear panel is in the proper position.

EXTENSIVE DAMAGE WILL RESULT IF THE AMPLIFIER IS CONNECTED TO THE WRONG SUPPLY VOLTAGE. UNDER NO CIRCUMSTANCES SHOULD THIS SWITCH BE OPERATED WHILE THE SUPPLY IS CONNECTED.

Connect the unit to the mains supply, switch it "on" and observe that the indicator lamp illuminates.

4.2 GAIN AND GAIN VARIATION

Equipment Required:
Oscilloscope (Tektronix T 921)
Sweep signal generators
(HP8601A, Wavetek 2001)
50 ohm video detector
(Wavetek D151)
10 dB 75W attenuator
(EMCO)

Procedure:

a. Set up the test equipment as shown in figure 4-1.

b. Set the oscilloscope to DC, time/cm to ext. x, and vertical gain to 10 mv/cm.

c. Set the sweep generator to the s/s mode with the start frequency at 1 MHz and the stop frequency at 150 MHz.

d. Disconnect the Model 325LA from the set-up and connect the sweeper/generator RF output directly to the 10 dB attenuator.

e. Adjust the output level of the sweeper/generator for full vertical deflection of the oscilloscope face.

f. Calibrate the scope face to show 3 dB in 1 dB steps and mark the traces with a grease pencil.

g. Return the sweep/generator output level to full deflection. Rotate the step attenuator on the sweep/generator (ccw) so that the output is reduced by 50 dB.

h. Reconnect the Model 325LA into the test set-up of Figure 4-1.

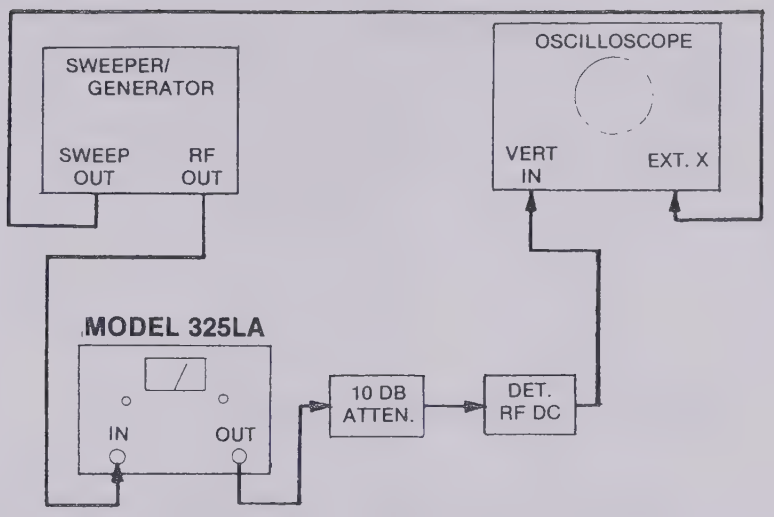


Figure 4-1. Gain and Gain Variation Test Set-up.

i. Turn on the Model 325LA power switch.

j. Observe the gain versus frequency sweep on the oscilloscope.

k. The average gain should be 50 dB (within 2 dB).

l. The gain variation should be within the 3 dB markings as shown on the oscilloscope face.

m. Repeat steps (a) through (h) using the HP8601 sweep/generator with start and stop frequencies at 250 kHz and 1 MHz respectively.

4.3 RF OUTPUT POWER TEST

The purpose of this test is to verify that the Model 325LA will deliver its rated power over the frequency range of 0.25 MHz to 150 MHz.

Equipment Required:

Signal generator (HP 8601A; Wavetek 2001)
Power Meter (HP 435B, 8482B power sensor with matching 30 dB attenuator)
Attenuator 10 dB 75W (EMCO)

Procedure:

a. Set-up the tet equipment as shown in Figure 4-2.

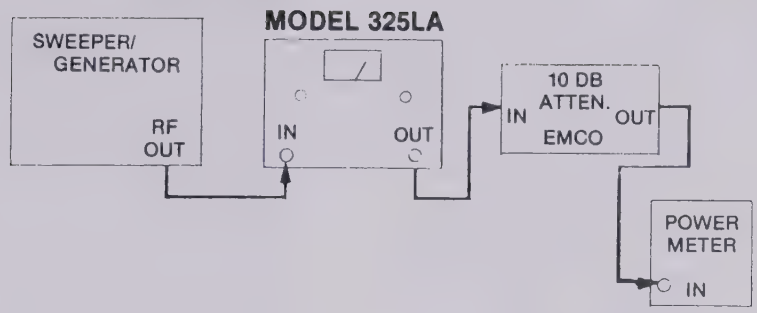


Figure 4-2 RF Output Power Test Set-Up

b. Set the power meter to the 10 watt range. With the 10 dB series attenuator, this corresponds to a full scale deflection of 100 watts.

c. Set the Sweep/Generator Wavetek Model 2001 to the CW mode, level to + 10 dBm and frequency to 150 MHz.

d. Slowly decrease frequency while observing the power meter. Note that at every frequency down to 1.0 MHz the power output is greater than 25 watts.

e. Using the HP model 8601A Sweep/Generator in the CW mode, level at + 10 dBm, frequency set at 1 MHz, slowly decrease frequency while observing the power meter. Note that at every frequency down to 250 kHz the power output is greater than 25 watts.

4.4 RF OUTPUT DISTORTION TEST

The purpose of this test is to verify that the harmonic distortion of the Model 325LA and hence its linearity is within specified limits.

Equipment required:

Signal generator (HP 8601A, Wavetex 2001)
Power meter (HP 435B, 8482B power sensor with
matching 30 dB attenuator)
Spectrum analyzer (HP 140T display unit, 8554L RF section,
8552A if section)
Attenuator (10 dB 75 W EMCO, 30 dB 200 w Bird 8322)

Procedure:

a. Set-up the test equipment as shown in Figure 4-3

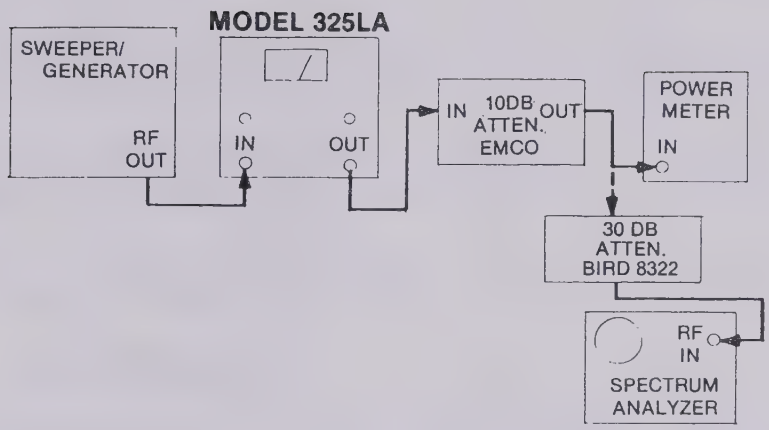


Figure 4-3. RF Output Distortion Test Set-Up

b. Set the power meter to 3 watt range. With the 10 dB series attenuator, this corresponds to a full scale deflection of 30 watts.

c. Set the Generator/Sweeper to CW and frequency to 150 MHz.

d. Adjust the Generator/Sweeper output level so that the output power indicated on the power meter is 20 watts.

e. Disconnect the cable from the power meter and connect to the Spectrum Analyzer through a 30 dB attenuator.

f. Observe that all harmonics are at least 23 dB below the fundamental.

g. Repeat steps a. through f. with the generator set at 10 MHz, 30 MHz, 80 MHz, 110 MHz, and 130 MHz, in succession.

h. Repeat steps a. through f. with HP model 8601A Sweep/Generator set at 250 kHz.

4.5 TROUBLE SHOOTING AND REPAIR

If the Model 325LA should fail to operate, and the panel light does not glow, check the condition of the fuse at the rear of the unit (4ASB 313004).

If the unit cycles on and off over a period of time, check the conditions of the fan filter (see maintenance instructions, section 4.6).

The Model 325LA circuit modules should be serviced only by the factory or its authorized facility. However, ENI will supply pre-aligned and calibrated module boards as replacement items.

DO NOT ATTEMPT to probe the circuit modules while they are mounted in the amplifier case, as extensive damage may result.

When factory service is required, the following steps should be taken:

1) Notify ENI, giving full details of the difficulty. Include the instrument's serial number.

2. Upon receipt of shipping instructions, forward the instrument, transportation prepaid, to the factory or to the authorized repair station indicated on the instructions.

An estimate of the charge will be made before the work begins, provided the instrument is not covered by the warranty.

4.6 MAINTENANCE

There are no periodic electrical adjustments required to maintain the amplifier gain and power output characteristics.

Periodic cleaning of the fan filter should be performed every six months under ordinary service conditions.

To remove the filter, unscrew the four #6-32 cap nuts on the rear panel and gently pry off the filter.

The filter may be cleaned with compressed air or soaked in an industrial cleaner such as toluene for a few minutes. After drying thoroughly, reassemble the filter on the rear panel using the removed hardware.

CHAPTER 5. SCHEMATICS AND PARTS LIST

5.1 SCHEMATIC DIAGRAMS

Complete schematic diagrams appear in figures 5-1 and 5-2.

5.2 PARTS LIST

Table 5-1 provides a listing of all electrical parts which may be required for replacement. Electrical parts are listed by module number and by reference designations as indicated on the schematic diagrams. Parts list includes a description, part number and manufacturers federal supply code number. Table 5-2 provides a reference glossary of abbreviations used in the parts list.

5.3 LIST OF MANUFACTURERS

Table 5-3 provides a correlation of the manufacturers federal supply code numbers used in the parts list with the names and addresses of the manufacturers. If ENI's manufacturer code number (10226) appears, that part must be obtained directly from Electronic Navigation Industries, Inc.

5.4 ORDERING REPLACEMENT PARTS

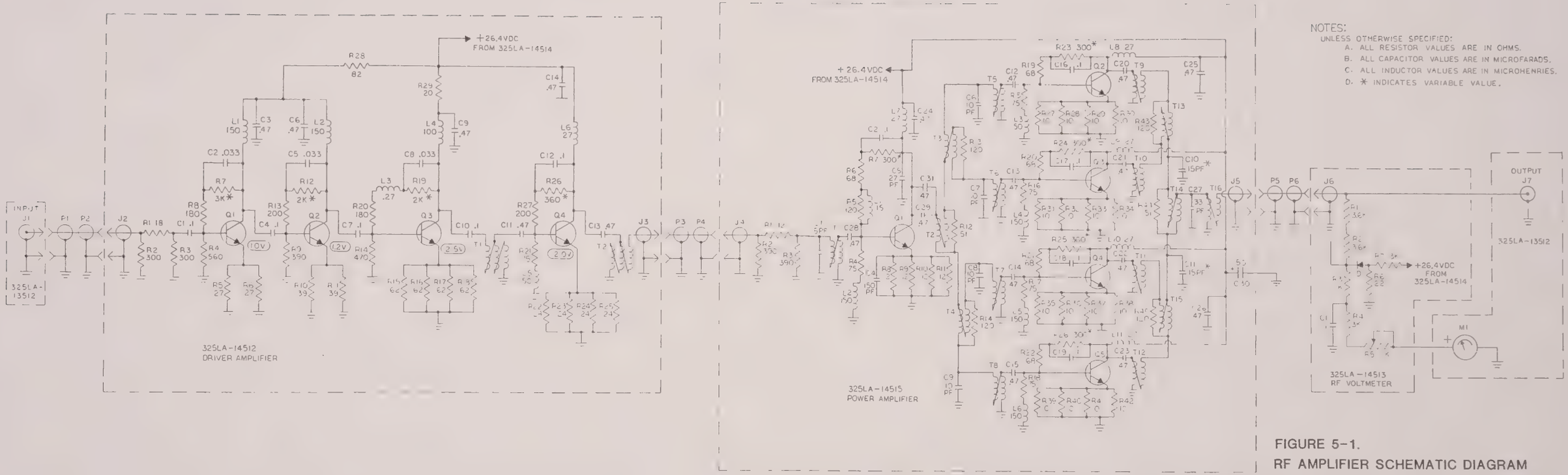
To obtain replacement parts, address order or inquiry to Electronic Navigation Industries, Inc. or its authorized service facility. Identify parts by number as listed in the parts list (Tables 5-1).

TABLE 5-1. REPLACEMENT PARTS LIST

REF. DESIGN.	DESCRIPTION	MFR. CODE	PART NO.
	Base Plate Assembly	10226	325LA-13511
T1	Transformer, Power	12715	AM5387
C1	Capacitor, 12000μF 40V	56289	36D123G040BC2A
CR1	Bridge Rectifier	04713	MDA-3501
K1	120 Volt AC Relay		KUP11AE5-120VAC
	Front Panel Assembly	10226	325LA-13512
M1	Meter	32171	834-469
S1	Switch, Illuminated	87034	616-6-1
J1,7	Connector	13511	UG657/U
	Rear Panel Assembly	10226	325LA-13514
B1	Fan	28875	WS2107FL
F1	Fuse, 4ASB	75915	313004
S2	Switch, 115/230	22753	622HK-115/230

REF. DESIGN	DESCRIPTION	MFR. CODE	PART NO.
	Power Supply Assembly	10226	325LA-13517
Q1	Transistor	79089	40312
Q2-5	Transistor	10226	ENI-1
R1-4	Resistor, .51Ω 2W	75042	1RC-BWH
	Power Supply Regulator	10226	325LA-14514
A162R1	Res. 47K ohm ¼W 5%	10226	Carbon Film
A162R2	Res. 2.7K ohm ½W 5%	16299	HC-5
A162R3	Res. 7.5K ohm ½W 5%	16299	HC-5
A162R4,5	Res. Potentiometer 200Ω	32997	3386T-1-201
A162C4	Cap. .1μF 50V	36346	C330C104M5U-1CA-C9250
A162C2	Cap. 150pF	09023	CM05FD151J03
A162C1	Cap. 560pF	09023	CM06FD561J03
A162C3	Cap. 50μF 50V	56289	500D506G050
A162L1	Choke .47μHy	99800	1537-06
A162IC1	Integrated Circuit	49956	RC723CT
	Driver Amplifier	10226	325LA-14512
A250R1	Res. 18 ohm 1/8W 5%	10226	Carbon Film
A250R2,3	Res. 300 ohm 1/8W 5%	10226	Carbon Film
A250R5,6	Res. 27 ohm ¼W 5%	10226	Carbon Film
A250R10,11	Res, 39 ohm ¼W 5%	10226	Carbon Film
A250R15-18	Res. 62 ohm ¼W 5%	10226	Carbon Film
A250R8,20	Res. 180 ohm ¼W 5%	10226	Carbon Film
A250R13	Res. 200 ohm ¼W 5%	10226	Carbon Film
A250R9	Res. 390 ohm ¼W 5%	10226	Carbon FIlm
A250R14	Res. 470 ohm ¼W 5%	10226	Carbon Film
A250R4	Res. 560 ohm ¼W 5%	10226	Carbon Film
A250R12,19, 7,26	Variable Value	10226	Carbon Film
A250R21	Res. 75 ohm ½W 5%	10226	Carbon Film
A250R22-25	Res. 24 ohm 1W 5%	10226	Carbon Film
A250R29	Res. 20 ohm 2W 5%	10226	Carbon Film
A250R27	Res. 200 ohm 2W 5%	10226	Carbon Film
A250R28	Res. 82 ohm 3W 5%	10226	Carbon Film
A250C2,5,8	Cap .033μF 50V	36346	C320C333M5U-1CA-C9250
A250C1,4,7, 10,12	Cap .1μF 50V	36346	C330C104M5U-1CA-C9250
A250C3,6,9, 11,13,14	Cap .47μF 50V	36346	C330C474M5U-1CA-C9250
A250L3	Choke .27μHy	99800	1026-00
A250L6	Choke 27 μHy	99800	2890-30
A250L4	Choke 100μHy	99800	2890-42
A250L1,2,5	Choke 150μHy	99800	3500-12

REF. DESIGN	DESCRIPTION	MFR. CODE	PART NO.
A250Q1,2	Transistor	10226	LT2001
A250Q3	Transistor	10226	CD2240
A250Q4	Transistor	10226	ENI-16
A250T1,2	Transformer	10226	
	Power Amplifier	10226	325LA-1415
A166,R5,13,14	Res. 120 ohm ¼W 5%	10226	Carbon Film
A166R1	Res. 12 ohm ½W 5%	10226	Carbon Film
A166R12	Res. 51 ohm ½W 5%	10226	Carbon Film
A166R4, 15-18	Res. 75 ohm ½W 5%	10226	Carbon Film
A166R2,3	Res. 390 ohm ½W 5%	10226	Carbon Film
A166R27-42	Res. 10 ohm 1W 5%	10226	Metal Film
A166R8-11	Res. 12 ohm 1W 5%	10226	Metal Film
A166R44	Res. 51 ohm 2W 5%	10226	Metal Film
A166R19-22	Res. 68 ohm 2W 5%	10226	Metal Film
A166R43,45	Res. 120 ohm 2W 5%	10226	Metal Film
A166R23-26	Res. 360 ohm 2W 5%	10226	Metal Film
A166C2, 16-19	Cap. .1μF	36346	C330104 MSU-1CA-C9250
A166C12-15, 20-26, 28, 29, 31	Cap .47μF	36346	C330C474MSU-1CA-C9250
A166C1	Cap 5pF	09023	CM05ED050J03
A166C6-9	Cap. 10pF	09023	CM05ED100J03
A166C10,11	Cap. 15pF	09023	CM0SED150J03
A166C5	Cap. 27pF	09023	CM05ED270J03
A166C27	Cap. 33pF	09023	CM05ED330J03
A166C4	Cap. 150pF	09023	CM05FD151J03
A166C30	Cap. 50μF 50V	56289	500D506G050
A166L1	Choke .15μHy	99800	1025-00
A166L7-11	Choke 27μHy	99800	2890-30
A166L2-6	Choke 150μHy	99800	3500-12
A166Q1-5	Transistor	10226	ENI-16
A166T1-15	Transformer	10226	
A166T16	Transformer	10226	
	RF Voltmeter	10226	325LA-14513
A251R6	Res. 22 ohm ¼W 5%	10226	Carbon Film
A251R3,	Res. 1K ohm ¼W 5%	10226	Carbon Film
A251R7, 4	Res. 3K ohm ¼W 5%	10226	Carbon Film
A251R1,2	Res. 3.6K ohm ½W 5%	10226	Carbon Film
A251R5	Res. Potentiometer 1K ohm	32997	3386T-1-102
A251C1	Cap. .1μF 50V	36346	C330C104M5U-1CA-C9250
A251D1	Diode	24840	5082-2811



NOTES:
UNLESS OTHERWISE SPECIFIED:
A. ALL RESISTOR VALUES ARE IN OHMS.
B. ALL CAPACITOR VALUES ARE IN MICROFARADS.
C. ALL INDUCTOR VALUES ARE IN MICROHENRIES.
D. * INDICATES VARIABLE VALUE.

FIGURE 5-1.
RF AMPLIFIER SCHEMATIC DIAGRAM

REV A 17 JAN 85
REV B 11 FEB 85

Figure 5-1. RF Ampilfier Schematic Diagram.

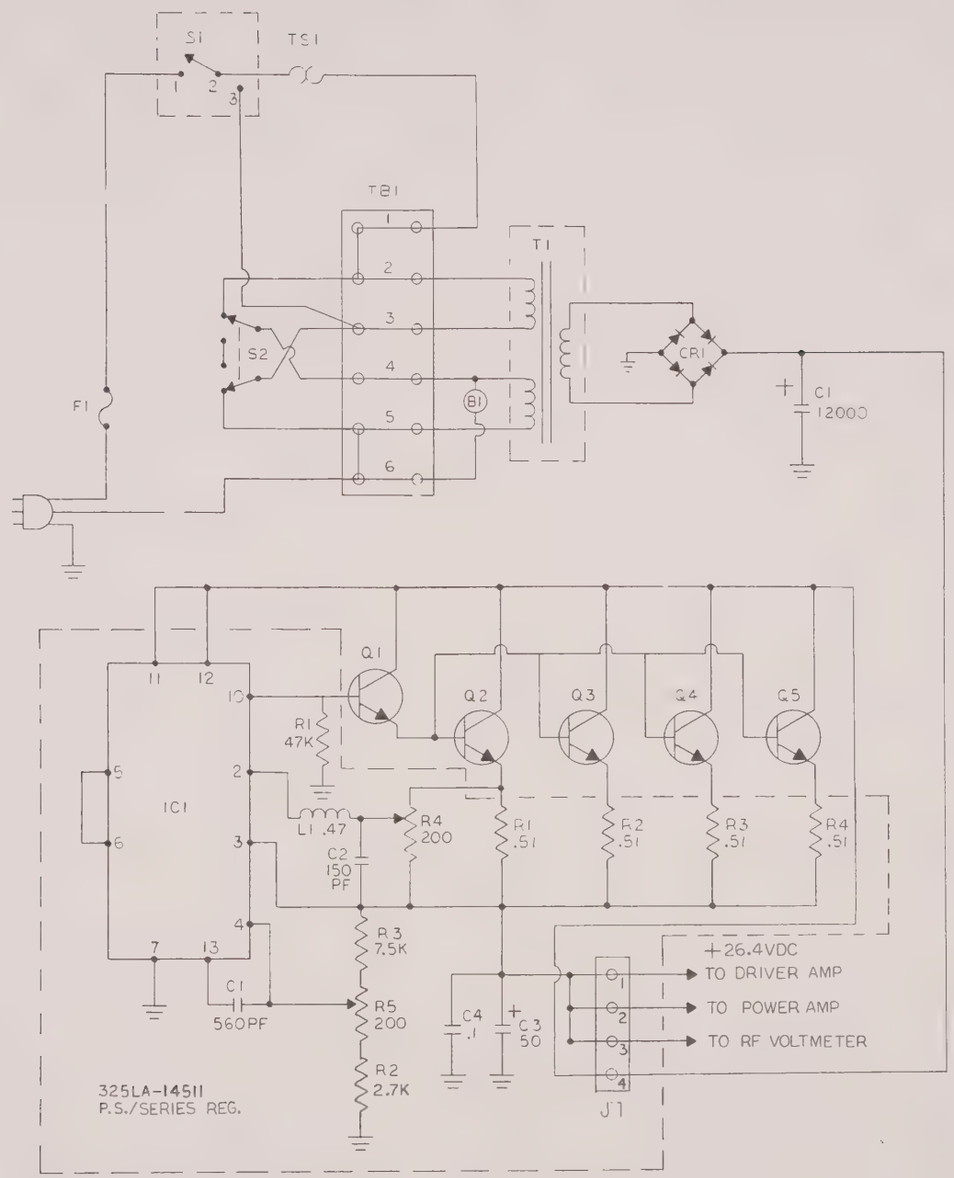
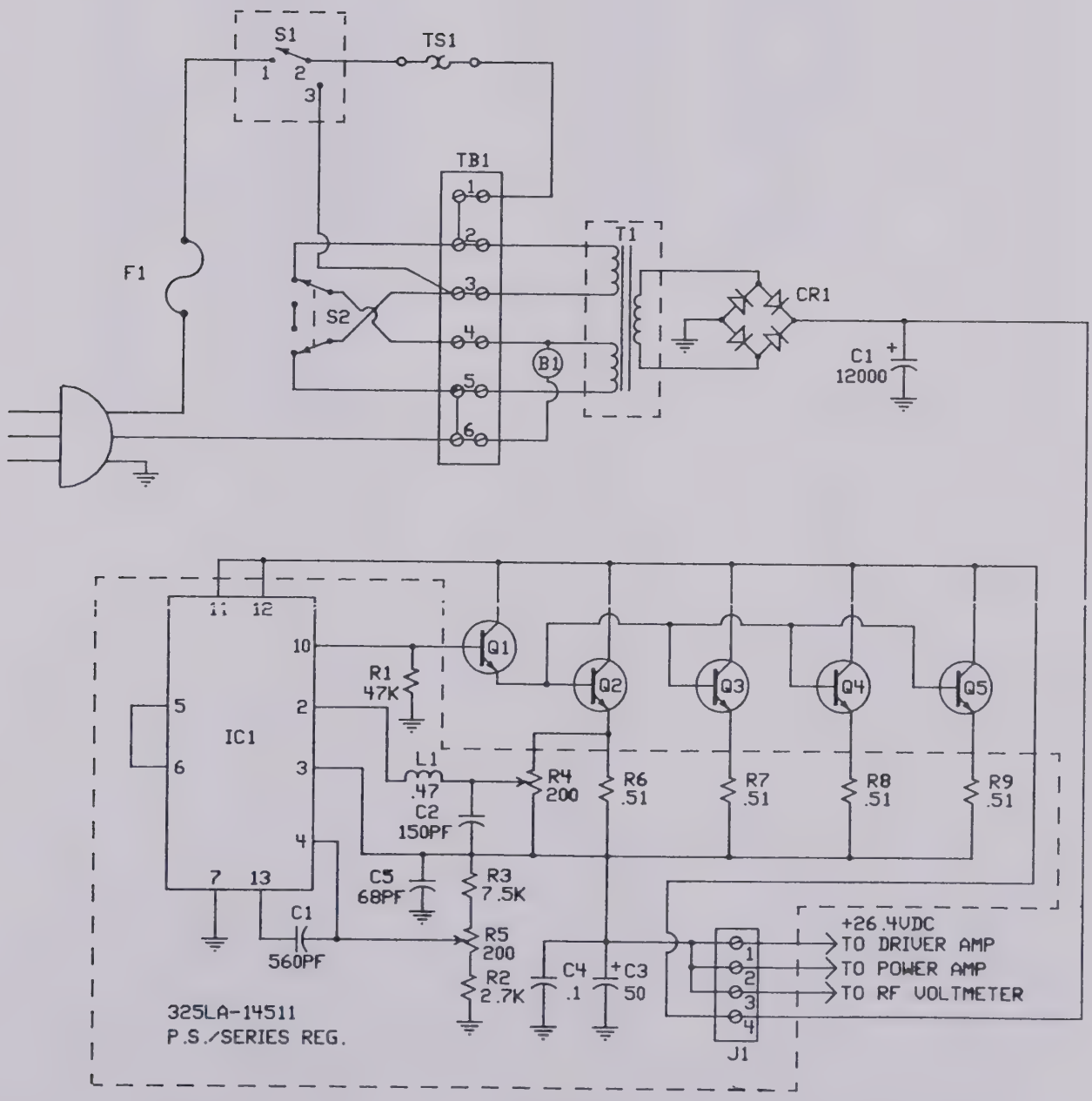


Figure 5-2. Power Distribution Schematic Diagram.



POWER DISTRIBUTION SCHEMATMIC DIAGRAM

FIGURE 5-2 LAST ECN 1384 5/2/88

TABLE 5-2. GLOSSARY OF ABBREVIATIONS

A	AMPERES	PIV	PEAK INVERSE VOLTAGE
AMP	AMPERES	POT	POTENTIOMETER
ASSY	ASSEMBLY	REF	REFERENCE
BR	BRIDGE	REQ	REQUIRED
CAP	CAPACITOR	RES	RESISTOR
CER	CERAMIC	S.B.	SLOW BLOW
COMP	COMPOSITION CARBON	μF	MICROFARAD
		V	VOLTS
DESIG	DESIGNATION	VDCW	DC WORKING VOLTS
ELECT	ELECTROLYTIC	W	WATTS
I.C.	INTEGRATED CIRCUIT	WW	WIRE WOUND
K	KILOHMS		
μH	MICROHENRY		
mV	MILLIVOLTS		
pF	PICOFARAD		

TABLE 5-2. LIST OF MANUFACTURERS

FEDERAL SUPPLY CODE NUMBER	MANUFACTURER	ADDRESS
04713	Motorola, Inc.	Phoenix, AZ
09023	Cornell-Dubilier Electronics	Sanford, NC
10226	Electronic Navigation Industries	Rochester, NY
12715	American Magnetics Corp.	Carterville, IL
13511	Amphenol Corp.	Los Gatos, CA
16299	Corning Glass	Raleigh, NC
24840	Hewlett Packard Co.	Palo Alto, CA
27191	Cutler Hammer	Milwaukee, WI
22753	Marco Oak Ind.	Anaheim, CA
28875	IMC Magnetics	Rochester, NH
29990	American Technical Ceramics	Huntington Station, NY
32171	Modutec, Inc.	Norwalk, CT
32997	Bourns, Inc.	Riverside, CA
36346	Union Carbide (Kemet)	New York, NY
49956	Raytheon Co.	Lexington, MA
56289	Sprague Electric Co.	N. Adams, MA
71744	Chicago Miniature Lamp Works	Chicago, IL
72619	Dialight Corp.	Brooklyn, NY
75042	I.R.C. Division of TRW, Inc.	Philadelphia, PA
75915	Littlefuse, Inc.	Des Plaines, IL
79089	R.C.A.	Harrison, NY
87034	UID Electronics Corp.	Hollywood, FL
99800	Delevan Electronics Corp.	E. Aurora, NY

FACTORY SERVICE

When Factory Service is required, the following steps should be taken:

(1) Notify ENI, giving full details of the difficulty. Include the instrument's serial nimber.

(2) Upon receipt of shipping instructions, forward the instrument, transportation prepaid to the factory or to the authorized repair station indicated on the instructions.

If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the warranty.